Generation of airborne speakers using laser-induced breakdown
レーザー励起プラズマを用いた空中スピーカーの生成

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High-power pulse lasers can generate plasma by focusing using a lens.This phenomenon is called laser-induced breakdown (LIB). LIBs emit shock waves and highly impulsive sounds. In this study, a femtosecond laser with a pulse width of 275fs and a repetition frequency of 1kHz to 1MHz was used to generate LIB in the air, and the laser gate signal was controlled by a pulse pattern created by modulating an arbitrary waveform with pulse frequency modulation (PFM) to reproduce any sound below the laser repetition frequency.

The frequency characteristics of the sounds produced by LIBs were obtained by playing the swept signals multiple times inside a self-made anechoic box, and then Fast Fourier Transmission (FFT) on the recorded results. The characteristics of the anechoic chamber were determined by measuring impulse responses using swept-sine signals. The results show that the sound pressure tends to increase toward high frequencies.

The results include noise due to modulation and the nonlinearity of the sound source, and I discussed the causes of the effects. An application of acoustic measurement and stereoscopic sound using the proposed method was proposed.

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